

MISSOURI

resources

Fall 2013 • Volume 30 • Number 3

Missouri  Resources
30 YEARS

director's comment

The Department of Natural Resources has experienced many new challenges, transformations and opportunities since we were first created in 1974. Through it all, the department has worked to enhance the quality of life for all Missourians and protection of our natural, cultural and energy resources. The most recent change came at the end of August when our agency said farewell to the Division of Energy and the Land Survey Program as their responsibilities and staff transition to different state government agencies.

The Missouri Energy Council was created in July 1973 to provide advice and guidance on state energy issues. The council served as an advisory body to the Missouri Energy Agency, which was created within the Department of Natural Resources in January 1975. Today, the Division of Energy monitors energy supplies, promotes energy efficiency and advances the use of Missouri indigenous energy resources to realize environmental and economic benefits through various initiatives and programs.

The Division of Energy has now transferred to the Department of Economic Development. This new and exciting opportunity for the division will help Missouri become an even stronger leader in energy production, innovation and promoting the wise

and efficient use of our energy resources. By capitalizing on both the Division of Energy's and the Department of Economic Development's strengths, they will promote the development of affordable, secure and diverse energy sources that will power our economy and create jobs for Missourians.

The Land Survey Program joined the department in 1974 during the reorganization of state government. The program protects the 250,000 corner monuments that form the basis of land ownership in Missouri, and maintains the Land Survey Repository. The repository contains approximately 1.8 million land survey records and geodetic survey data, which represent the basis for all land titles in the state.

The Land Survey Program and Land Survey Commission now reside within the Department of Agriculture where they will continue to develop and provide information required for the accurate location and documentation of property boundaries in Missouri.



On behalf of our staff, I'd like to thank our colleagues within the Division of Energy and Land Survey Program for their past service and dedication to this agency and the citizens of Missouri. The staff of the Missouri Department of Natural Resources wishes them continued success in the future.

A handwritten signature in black ink that reads "Sara Parker Pauley". The signature is fluid and cursive.

Sara Parker Pauley
Missouri Department of Natural Resources

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Mission Statement

The mission of the Missouri Department of Natural Resources is to protect, preserve and enhance Missouri's natural, cultural and energy resources.

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Editor

Stuart Westmoreland

Design Director

Belinda Hughes

Photographer

Scott Myers

Public Information Coordinator

Andrew Richmond

Circulation

Luke Petree

Nicci Bouse

Editorial Board

Larry Archer

Andrea Balkenbush

Hylan Beydler

Renee Bungart

Steph Deidrick

Stuart Westmoreland

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DEPARTMENT OF
NATURAL RESOURCES

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Above: The Clifty Hollow Natural Bridge in Maries County is one of Missouri's most picturesque geologic wonders.

Cover: Fall trees glow in the afternoon sun along the Island Trail in Ha Ha Tonka State Park.

DNR photos by Scott Myers.



PLAYGROUND WITH A PAST

Sinkhole cleanup addresses decades of dumping

by Larry Archer

Most children growing up in the 1960s felt fortunate if they could spend their backyard playtime swinging on a swing set, digging in a sand box or hiding in a tree house. As a child growing up in rural Laclede County, Doug Goodwin had his own special play area - **the family sinkhole**.

Located on a small portion of the Goodwin family's 200-plus acre farm in northern Laclede County, the sinkhole offered adventure unlike any tire swing or sandbox.

"It was a kid's playground," said Goodwin.

He soon learned that, unlike most playgrounds, this one had a past. An elderly neighbor provided him with history lessons found in no textbook he had encountered in school.

"When I was a little kid I would sit at her feet and she'd tell stories," he said.

During the Civil War, she would tell him, area residents would take shelter in the cave into which the sinkhole drains in order to avoid the violence that was the Border War between Missouri and Kansas. His parents purchased the property that included the sinkhole in 1954.

"When they first bought the farm, the old-timers said (the cave) went back about a quarter mile," he said. "When Mom and Dad bought it, they said they could walk quite a ways in there."

As he was growing up, entry to the cave was prevented as its historic legacy fell victim to a new legacy - illegal dumping.

Its proximity to Lancaster Road - some sources even refer to the site as the Lancaster Road Sinkhole - made illegal dumping convenient, and the sinkhole and the cave became congested with trash after decades of such abuse.

"My mom always tried to get the dumping stopped and she never could," Goodwin said.

Facing similar frustration, Goodwin reached out to Klaus Leidenfrost of the Missouri Cave & Karst Conservancy, a land trust organized to conserve caves and karst areas in Missouri. Karst areas are known for their caves, springs, sinkholes

More than nine tons of tires have been pulled from the Goodwin Sinkhole since cleanup began in 2012. DNR photo by Jim Vandike



and losing streams caused by the dissolution of subsurface dolomite and limestone over time. The conservancy frequently purchases threatened caves and karst areas, assists landowners with preservation, educates Missourians on cave and karst issues, and, when necessary, coordinates the cleanup of sites like Goodwin Sinkhole.

"Klaus showed me pictures of things they had done before," Goodwin said. The prospect of seeing the site returned to its natural state prompted Goodwin to donate the roughly one-acre site to the conservancy and allow access to it via his property.

In his initial visits to the site, Leidenfrost described it as being identical to a regular landfill, with clothes, car parts, household waste and tires. Lots of tires.

"I counted 400 or 500 tires just on the surface," he said.

The conservancy's cleanup of the site began in early 2012, and according to the

organization, by the end of the year volunteers had cleared an estimated 43,760 pounds of trash, more than 9 tons of tires and more than 2,500 pounds of metal.

To facilitate the removal of the surface trash, the department's Solid Waste Management Program arranged, through a settlement case with a landfill company, for the use of roll-off dumpsters and the waiving of hauling and disposal fees for the trash. Through its scrap tire unit, the program also made sure tires removed from the site were properly disposed.

The effort took more than just conservancy members and those with a direct interest in cave preservation. The breadth of involvement – from volunteers to state agencies to equipment operators who donated or discounted their services – has set this project apart from previous sinkhole cleanups that Leidenfrost has coordinated.

"Some of them are cavers," he said.

(Above left) Soldiers from Fort Leonard Wood are among the many volunteers who have contributed hundreds of hours to the cleanup efforts.

Klaus Leidenfrost photo

(Above right) Stormwater runoff flowing through the accumulated trash in Goodwin Sinkhole represents a threat to groundwater quality in the area. Dye tracing at the site has confirmed that water flowing into the sinkhole eventually makes its way to nearby Hahatonka Spring in Camden County.

DNR photo by Jim Vandike



(Left) Klaus Leidenfrost of the Missouri Cave & Karst Conservancy stands atop some of the hundreds of tires that have been removed from the sinkhole since 2012.

DNR photo by Sherri Stone



(Above) Volunteers have worked through the heat of summer and the cold of winter in their attempt to bring the sinkhole back to its original condition. (Right) A relay line of volunteers forms to move materials out of the mouth of the cave into which the sinkhole drains. (Bottom) Heavy equipment is used to remove trash buried by years of silt build-up.

Klaus Leidenfrost photos



“We’ve had Boy Scouts, teachers, soldiers from Fort Wood. It’s a mish mash.”

Instrumental in this army of volunteers has been the U.S. Army, he said. “Our biggest help lately has been Fort Leonard Wood. We could not do it without them.”

In 2012, the first year of the conservancy’s efforts at the site, all of the trash above the ground was removed. Still, decades of silt and soil accumulation has buried an unknown amount of additional trash underground.

“Some places we’ve dug down 15 feet and we’re still finding trash,” he said.

The Department of Natural Resources’ Environmental Services Program used a hydraulic soil probe to help establish how deep the trash went. The results showed the sinkhole was filled with soil, gravel and trash to depths of more than 30 feet.

According to Leidenfrost, the focus of work in 2013 has been on the buried trash and opening the cave, but spring rains have slowed work, frequently washing sediment back into previously excavated areas.

“When we get a lot of rain it can change everything,” he said. “Sometimes the work is undoing what happened since the last time you were there.”

Because of the difficulty – and danger – of working in the summer heat, the conser-

vancy took a hiatus from scheduled cleanups during the summer with the intention of resuming the project this fall. In the meantime, Leidenfrost has been working on the effort's biggest challenge – finding additional support for the project.

"It all boils down to dollars," he said. "There's so much material there."

An additional challenge to returning the site to its original condition is the lack of information about the area as it appeared in its original state.

"Nobody knows what it looked like before," Leidenfrost said. "No one can find any photos of it before the dumping."

The sinkhole had become more than just a trash-laden eyesore. It was a threat to local groundwater and to one of Missouri's largest springs, Hahatonka Spring. This beautiful spring, located in Ha Ha Tonka State Park in neighboring Camden County, discharges 50 million gallons of water daily into the Niangua Arm of the Lake of the Ozarks, making it the state's 12th largest spring.

Stormwater runoff from nearly 100 surrounding acres drains into Goodwin Sinkhole. Dye tracing conducted by the Department of Natural Resources' Geological Survey Program in 1980 established that drainage into the sinkhole flows directly to Hahatonka Spring, which is approximately 11 miles northwest of the depression.

For decades, that stormwater runoff filtered through the pollutants found in the sinkhole before the then-contaminated groundwater headed to the spring. A similar

dye trace in 2009 confirmed that the drainage to the spring had not changed.

In all, the trash in the sinkhole represented a multi-media environmental concern, involving solid waste, water pollution and impairment of the ability of Hahatonka Spring to recharge.

"It was a combination of a solid waste dump; obstruction of a natural sinkhole and karst feature by trash, soil and gravel; and inhibition of the recharge," according to Tim Rielly, restoration and assessment manager with the department's natural resource damages unit. "It had all the effects of a small-scale landfill."

The department's Water Pollution Program also awarded a \$10,000 grant to the Meramec Regional Planning Commission, which used the money to aid in the cleanup. The fund from which the grant was given is dedicated to addressing water pollution related to stormwater runoff.

More than the spring is at risk to pollution entering the groundwater through Goodwin Sinkhole and other karst features like it, Goodwin noted. Drinking water wells located in a wide radius of pollution are also a concern, he said.

"We learned a long time ago that we drink whatever we dump," he said.

Find out more about the Missouri Caves & Karst Conservancy at mocavesandkarst.org/. 🌅

Larry Archer is the division information officer for the department's Division of Environmental Quality.

Environmental specialists from the Department of Natural Resources' Environmental Services Program were able to determine the depth of the trash in the sinkhole by taking samples with a hydraulic soil probe.

DNR photo by Scott Myers



Create a Sinkhole Map

Staff geologists provide assistance to citizens by evaluating the causes and impacts of sinkhole formation and collapse. They also maintain a database of sinkholes that are documented or are

found on U.S. Geological Survey topographic maps. You can create a map showing known sinkholes and learn more about sinkhole formation and mitigation -

go to dnr.mo.gov/geology/geosrv/envgeo/sinkholes.htm.



The Sunny Side of the Street

by Angie Morfeld



Bob Phelan/ Missouri University of Science & Technology photo

An aerial view of Solar Village, located on the Missouri S&T campus, showcases homes built in previous Solar Decathlon competitions. Clockwise, starting from front center, the 2007 home, the 2009 home, the 2002 home and the 2005 home.

I arrived at the Solar Village – a collection of four small homes situated on the outskirts of the Missouri University of Science and Technology (Missouri S&T) campus in Rolla – on a stormy Tuesday morning in May. The storm was of the typical late spring variety, cloudy with bursts of heavy rain and a little lightning and thunder mixed in for good measure. But walking into the homes on this unique piece of real estate, you wouldn't have known there was a cloud in the sky. Inside the homes, the power of the sun was in full effect.

That is because all four homes are completely powered by the energy of the sun.

Each home was designed and constructed over the past decade by the Missouri S&T

Solar House Team, composed of undergraduate students, in order to compete in the Solar Decathlon. The biennial event is a collegiate competition sponsored by the U.S. Department of Energy (DOE).

"This area is literally one of a kind," said Emily Vandivert, project manager for the 2013 Solar House Team. "Missouri S&T is the only university in the world with a community of student-designed-and-constructed solar homes."

The Solar Decathlon challenges each college team to design, fund, build and operate solar-powered houses that are cost-effective, energy-efficient and attractive. The competing teams spend nearly two years creating their homes.

“The challenge is to not only design and construct a sustainable, net-zero solar house, but to market it as a viable residential option,” Vandivert said. “It has to be appealing to those in the market for a home.”

Getting In

Just getting into the decathlon is no easy feat, Vandivert says. Colleges, universities and other post-secondary educational institutions worldwide are invited to submit proposals for the competition. Each proposal is reviewed, scored and ranked by representatives of DOE and the National Renewable Energy Laboratory. Only 20 schools are selected to participate.

Missouri S&T’s Solar House Team competed in the 2002, 2005, 2007 and 2009 Solar Decathlons, building an 800-square-foot home in each of those competition years. The Solar Village showcases the products of those competitions.

“We narrowly missed the 2011 competition,” Vandivert said. “We were selected as number 21, or first runner-up.”

The team is currently preparing for the 2013 competition, their fifth, scheduled for Oct. 3-13 at Orange County Great Park in Irvine, Calif. Missouri S&T is the only school to have been accepted into five of six Solar Decathlons.

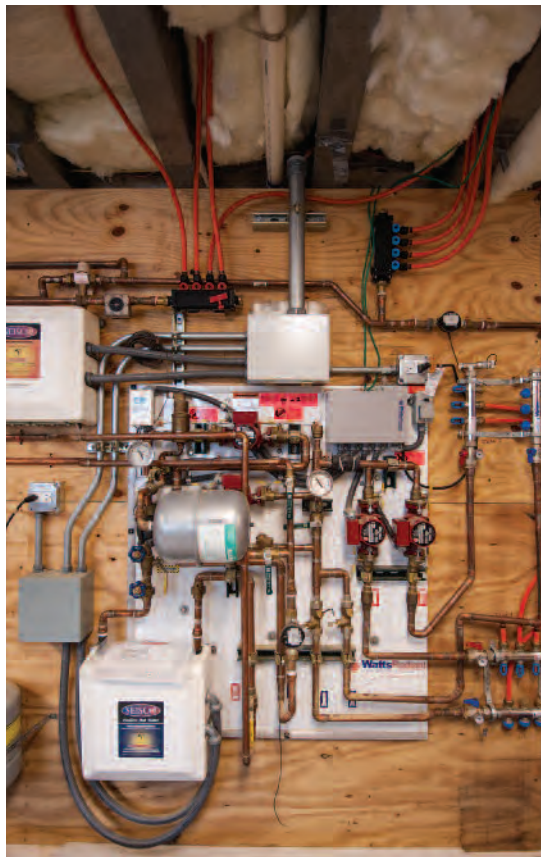
This year’s project is known as the Chameleon House, a 1,000-square-foot adaptable living environment. The square footage requirement was increased from 800 to 1,000 during the 2011 competition.

“Much like a chameleon, the home will feature several innovative aspects that can transform to suit the needs of the occupant,” Vandivert said.

One such innovation is an advanced, Web-connected automation system that provides an unprecedented level of control over the living space. A similar prototype automation system was used in the 2009 house, but with technological advancements, the size and price of the system being used for the 2013 solar house have dropped tremendously.

“Whereas the price of the system in 2009 was about \$20,000, the price for the system in the Chameleon House is an affordable \$1,400,” Vandivert said. “And it doesn’t require as much wiring and wall space. The 2013 system is comparable to the size of a pack of gum.”

That reduction in price for the system is a bonus for the team. An affordability com-

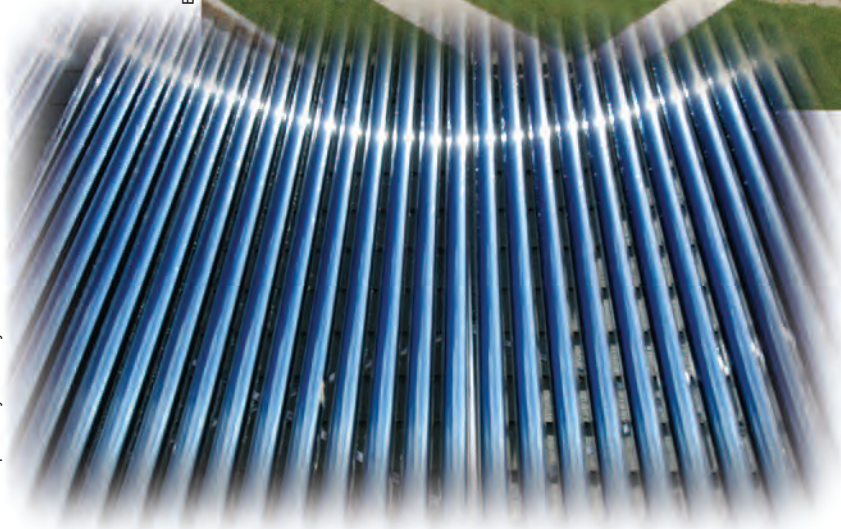


(Left) The mechanical systems of the home built for the 2009 competition are located in the basement. Technological advancements since then have caused tremendous drops in both the price and size of these systems. (Bottom) An interior view of the competition home built in 2005. This design was based on Frank Lloyd Wright's style of architecture and the Golden Ratio.

DNR photo by Scott Myers



DNR photo by Scott Myers



(Top) With four homes, the team has outgrown the available space at Solar Village, so Chameleon House will be installed in a new, renewable-energy space on campus after the 2013 competition.
(Above) A close-up of a solar panel from a home in the Solar Village.

ponent also was added to the competition in 2011 – all teams must stay at or below \$250,000 in construction costs.

Preparing for the Contest

There is a lot of work leading up to the competition, including fundraising. Qualifying teams must raise money to cover construction and expenses. Each selected team receives \$100,000 from the U.S. Department of Energy. The rest of the money is raised through donations, special events and grants, such as an \$8,000 grant from the Missouri Department of Natural Resources’

Division of Energy. The division recently was reassigned to the Missouri Department of Economic Development.

“We have to get creative with our fundraising,” Vandivert said. “We have a winning team of students, advisers and sponsors, but experience has taught us that we can never have enough help. The great things we do would not be possible without donations from generous people.”

When the funds start coming in, the construction can start. The team must fully construct their home on campus prior to the contest. Then just before the start of the decathlon, the house is meticulously disassembled into large pieces, put on trucks and transported to the event site. The team then has nine days to reassemble it.

“Once we get to the competition, we are working at break-neck speed to get the house back up and in working order,” Vandivert said. “After it is reassembled, it stays up for judging and public exhibition over a two-weekend period.”

The team then has only five days to disassemble it, at which time it is shipped back to its permanent home on the Missouri S&T campus. That is how Solar Village was born, and how it grows. Once reconstructed on campus, the homes not only serve as campus housing, but help educate the public and provide research opportunities.

Vandivert says the team sees their work and the competition as a way to showcase and help market solar energy, what it is and what it can do.

Into the Future

Future plans for the Solar Village include installing a microgrid, which will tie the existing four solar homes together in order to share power. It's another step forward in sustainability, according to Vandivert.

"If one home doesn't have enough power, but the neighboring house has extra, it can pull from the microgrid and continue running as normal," Vandivert added.

The team has outgrown the available space in the Solar Village, so once the 2013 competition is over, the university plans to allow space for the Chameleon House in a renewable-energy site being developed on campus. The new location is known as the E3 Commons.

"The competitors are extraordinarily excited to see the Chameleon House transition from blueprints and specifications into an actual building," Vandivert said.

The group completed its first-round assembly of the home in August, which was marked with a ribbon-cutting ceremony on the Missouri S&T campus.

Now, it's on to California.

For more information about the Solar Village or the Solar House Team, visit experiencethis.mst.edu or solarhouse.mst.edu.

For a virtual walk-through of the Chameleon House, visit youtube.com/watch?v=udLvGUwcHCs. ☀️

Angie Morfeld is a public information coordinator for the Missouri Department of Economic Development's Division of Energy. The division was transferred from the Department of Natural Resources to the Department of Economic Development in August 2013.

(Top) Emily Vandivert and Chris Bowe stand inside the Chameleon House. Emily and Chris are members of the Solar Decathlon team for Missouri S&T, and will compete in the decathlon in the fall of 2013.

(Right) The Chameleon House is currently being built on the Missouri S&T campus. Once completed, it will be dismantled and shipped to California to compete in the U.S. Department of Energy's Solar Decathlon 2013 in fall 2013.

DNR photo by Scott Myers



DNR photo by Scott Myers

Categories of Competition

Much like the Olympic decathlon, the Solar Decathlon consists of 10 contests:

- | | |
|------------------|----------------------|
| ● Architecture | ● Comfort Zone |
| ● Market Appeal | ● Hot Water |
| ● Engineering | ● Appliances |
| ● Communications | ● Home Entertainment |
| ● Affordability | ● Energy Balance |

Each contest is worth a maximum of 100 points, for a competition total of 1,000 points. The winning team produces a house that is affordable, attractive and easy to live in; maintains comfortable and healthy indoor environmental conditions; supplies energy to household appliances for cooking, cleaning and entertainment; provides adequate hot water; and produces as much or more energy than it consumes.





Arches, Bridges and Tunnels

Nature's Great Construction Projects

by Joe Gillman photographs by Scott Myers



Images of the yellow-red sandstones of the American West with their majestic spans likely come to mind when many Missourians think of a natural bridge or rock arch. Yet, Missouri has more than 85 documented natural arches, bridges and tunnels. While most do not adorn postcards or serve as the backdrop for movies, they do represent some very striking geology.

The state has a diverse and complex geologic makeup and the karst geology that dominates the Ozarks region is well known. Karst areas are underlain by weathered, soluble rocks such as limestone, dolomite and sandstone. While not all natural bridges form in the Ozarks, these karst conditions are the perfect environment for natural bridges to take shape in the state's abundant bedrock that consists of these materials. Natural arches, bridges and

tunnels have been created as a result of stream piracy, collapsed caves or rock slices.

Like a Thief in the Night – Stream Piracy

Missouri's natural arches, bridges and tunnels come in many sizes, shapes, heights and widths. No two are alike. Some are large. Some are small. Some stand as sentinels of the landscape while others are neatly tucked into the contours of the ground and may go unnoticed. Often, these features are formed by complex geologic processes. These processes include stream capture by an adjoining drainage system. Each can result in the formation of a natural arch, tunnel or bridge. Further erosion and weathering can then sculpt these features into impressive monuments of the geologic record.

"Stream piracy is a geologic process where a surface stream is captured or 'pirated' by another, adjacent drainage feature," said Carey Bridges, director of the department's Geological Survey Program. "This capture essentially is a case of one stream taking a shortcut into another stream through a small cave or fracture in the rock. Through time, this natural opening is enlarged and the entire stream is rerouted through the cave, leaving behind a natural bridge," Bridges added.

An outstanding example is Clifty Hollow Natural Bridge in Maries County. This natural bridge, first described by the Missouri Geological Survey in 1857, is located within the Missouri Department of Conservation's Clifty Creek Natural Area. The

bridge is developing where a small tributary to Clifty Creek penetrates a narrow rock ridge, composed of Gasconade dolomite – a rock unit from the Ordovician time period between 500 and 444 million years ago – and flows into Clifty Creek. The tributary once traversed the length of the ridge and now runs along its base. Today, it flows directly through a large opening beneath the ridge, thereby creating the natural bridge. The arch spans approximately 40 feet and is 13 feet high with a picturesque, serene setting.

That Sinking Feeling – Collapsed Caves

Missouri is world-renowned for its many spectacular caves. These caves exhibit distinctive subsurface environments and often add a variety of other interesting geologic features. Collapsed cave systems sometimes aid in the formation of Missouri's natural stone bridges.

"This process involves a mature cave system that becomes partly destroyed by erosion and weathering. The natural bridge or natural tunnel forms when adjacent parts of the cave collapse and leave behind what is known as a cave remnant," Bridges said. "This preserved remnant then becomes the natural tunnel or natural bridge."

Grand Gulf State Park in Oregon County has a textbook example of this geologic wonder within what is quite possibly Missouri's most impressive karst complex and collapsed cave system. Geologists determined the location and orientation of the



(Above) Clifty Hollow Natural Bridge, in Maries County, is 40 feet high and 25 to 30 feet wide. The arch has a span of 40 feet, and is 13 feet high.

(Opposite page, top) Kaintuck Hollow Natural Tunnel, in Phelps County near Rolla, lies within Mark Twain National Forest. A small spring on the upstream end of the tunnel keeps the tunnel floor wet in a few places. When the tunnel was named, "Kaintuck" was local dialect for "Kentucky."

(Opposite page, bottom) The 175-foot-long Kaintuck Hollow Natural Tunnel was formed when a cave system collapsed, leaving part of the cave roof intact.



original cave formed along a faulted zone in the Jefferson City dolomite. Like the Gasconade dolomite, this is a rock unit from the Ordovician time period.

Part of the former cave roof is still intact and forms Grand Gulf Natural Bridge. This extraordinary geologic feature provides a

rare glimpse into the inner workings of a subterranean world.

Other notable natural bridges and tunnels that have formed as a result of this type of geologic phenomenon include Rock Bridge in Rock Bridge State Park in Boone County, Kaintuck Hollow Natural Tunnel in Phelps

Natural Bridge



Over time, a natural opening on the surface can be enlarged by flowing water, leaving a natural bridge that spans the valley of erosion.

Natural Tunnel



Cave systems that become partly destroyed by erosion and weathering can lead to the formation of natural tunnels with openings at both ends.

Formation of a Natural Arch



Erosion and weathering aid in the formation of natural arches.

DNR graphics by Mark Gordon

County, Hahatonka Natural Bridge in Camden County, and Bennett Spring Natural Tunnel in Laclede County.

A Slice in Time – Rock Slices

Rock slices are another way in which arches form and are commonly found immediately adjacent and parallel to a rock wall or bluff.

“These arches owe their formation to fractures that are oriented parallel to the bluff face,” Bridges said. “The fractures become enlarged through time and subsequently, part of the rock wall isolates itself from the main wall along this fracture. Through additional weathering and erosion, a slice-type arch can form.”

Many of these arches have the classic arched appearance and can be quite impressive in size and prominence. The Hootentown Natural Arch in Stone County contains four geologic formations from base to crest that include (listed oldest to youngest): the Northview shale, the Pierson limestone, the Reeds Spring limestone, and the Elsey limestone. These rock units are from the Mississippian time period between 345 and 320 million years ago. This arch is quite likely the largest natural arch in Missouri. It rises 80 feet from base to crest with a span of 80 feet. Paddy Creek Natural Arch in Texas County and the Devils Tables Natural Arches in Laclede County are examples of slice-type arches that formed adjacent to steep rock bluffs.

Missouri’s natural arches, bridges and tunnels also have a storied history. Natural Bridge Road in St. Louis was so named because the original road, which was planned in the 1840s, passed over a natural rock arch under which Rocky Branch Creek once flowed. The rock bridge, which has long succumbed to the pressures of urbanization, was reportedly located near the current intersection of 23rd and Palm streets, and stood a short distance from the man-made arch that now towers over the St. Louis skyline.

Natural arches also have been used as landmarks. Early travelers were well aware of the river landmark Roche Percee – French for “pierced rock” – Natural Arch located high atop a bluff near the Perche Creek and Missouri River confluence. This feature was first documented by Scottish explorers in the 1790s and later noted in Lewis and Clark’s journals documenting their voyage up the Missouri River. Visitors who journey along Katy Trail State Park in

this region can still behold this significant geologic feature. Not to be outdone by historical importance, local legend holds that Blackbeard’s Cache Natural Bridge, located in Jefferson County, is the site where Blackbeard the Pirate and crew buried treasure. Although it is highly unlikely that pirate loot is indeed buried there, it does serve as an interesting folktale and provides a unique name for this feature.

Many of these stone structures have been utilized for various purposes throughout history from human habitation by native cultures to modern-day recreation areas. Others have been the preferred locations for water mills, dance halls, breweries, livestock shelters, tourist destinations and other festive or practical purposes.

Remarkable examples of these geologic works of art can be seen in Missouri’s recreation areas and state parks. Why not visit Rock Bridge Memorial State Park, Bennett Spring State Park, Clifty Creek Natural Area or Kaintuck Hollow and see nature’s handiwork for yourself?

Most of Missouri’s natural arches, bridges and tunnels are located on private property. It is important to respect private property rights and request permission before attempting to observe geologic landmarks that do not have public access.

More information about these and other fascinating geologic features can be found in the popular book published by the Geological Survey, *Geologic Wonders and Curiosities of Missouri*, available at missourigeologystore.com. 🌞

Joe Gillman is state geologist and director of the Missouri Geological Survey, a division of the Department of Natural Resources.



(Above) Hikers and bikers at Katy Trail State Park can find Roche Percee Natural Arch at mile marker 166.9, between McBaine and Easley, south of Columbia. Cut into the rock, high on a bluff, the arch is 25 feet high and 15 feet wide.

(Opposite page, top) Rock Bridge Memorial State Park, near Columbia, is named for the massive 125-foot-long natural limestone tunnel with a stream flowing through it. A boardwalk leads from the tunnel to nearby Devil’s Icebox, a collapsed sinkhole with an entrance to a cave system.

GOVERNOR'S 100 MISSOURI MILES CHALLENGE

by Tom Uhlenbrock

Hiking the Whispering Pines Trail in Hawn State Park or floating the Akers-to-Pulltite section of the Current River are always rewarding experiences.

But now the two outings offer a bonus. Together, they total 20 miles in the outdoors and would represent a fifth of the goal in the Governor's 100 Missouri Miles Challenge.

Gov. Jay Nixon and First Lady Georganne Nixon have posted the challenge for all Missourians to follow them and complete 100 miles of physical activity by the end of the year. You can hike, run, paddle, pedal or roll on any of Missouri's trails, parkways or streams.

The Nixons are avid promoters of the beauty found in the diverse landscapes of Missouri. The governor visited all 87 state parks and historic sites, and says touring the parks, prairies, rivers and trails is an enjoyable way to combat two growing epidemics – obesity and what sociologists call “nature deficit disorder.”

“In the digital age, these outdoor traditions are more important than ever – for the sake of our heritage, and our health,” Nixon said in remarks kicking off the challenge. “Think about it: You can spend hundreds of dollars on the latest Xbox, iPad or flat-screen television, or you can turn off the gadgets, get off the couch, walk out the door and have fun in the real world, for free.”

“Outdoor activities aren't just fun, they're good for you. Even a small amount of physical activity on a regular basis can have a big impact on your overall health and well-being.”

Nixon pointed out that Missouri recently was named the “Best Trails State” by American Trails, a national, nonprofit organization work-



DNR photos by Scott Myers

(Above) Missouri State Parks has more than 230 trails in 58 parks and historic sites totaling nearly 1,000 miles.

(Inset) Visitors to Missouri State Parks have a variety of trail options for all ages and activity levels to enjoy.



DNR photo by Scott Myers



DNR photo by Tom Uhlenbrock

ing on behalf of the nation's hiking, biking and riding trails. The award is presented every two years to the state that has made tremendous contributions to promote and improve its trail system.

The state park system has more than 230 trails in 58 parks and historic sites. A guide to all of them, Trails of Missouri State Parks, is available at mostateparks.com and helps visitors choose a hiking trail based on their needs and skill levels.

"Missouri has an outstanding system of trails that can accommodate a wide variety of activities ranging from a short walk to a hike through the wilderness," the governor said. "I encourage all Missouri families to get out there and take advantage of this incredible resource found right here in the Show-Me State."

To join the Nixons in recording 100 Missouri Miles, participants can register for the challenge at 100missourimiles.com. After signing up, you can log on to record your own miles with each individual outing. Up-to-date totals for the Nixons are listed on the site.

Missourians also can connect with the challenge through Facebook at facebook.com/100MoMiles, and through Twitter at twitter.com/100MoMiles.

The governor noted that trails not only are free, fun and good for you, they also add to the state economy. A recent study showed that the Katy Trail alone generates nearly \$18.5 million a year in economic impact

for the state and supports hundreds of jobs. The Governor's 100 Missouri Miles Challenge is a partnership with Missouri State Parks, a division of the Missouri Department of Natural Resources; the Missouri Department of Health and Senior Services; and the Missouri Division of Tourism.

"Over the coming weeks and months, we will travel 100 Missouri Miles, on back-country hiking trails and bike paths, on suburban greenways and city parks, through dense wilderness and tall prairie grass," Nixon said.

"Whether you're up for hiking across the state on the Katy Trail, or walking around a local park – we want everyone to participate." 🌅

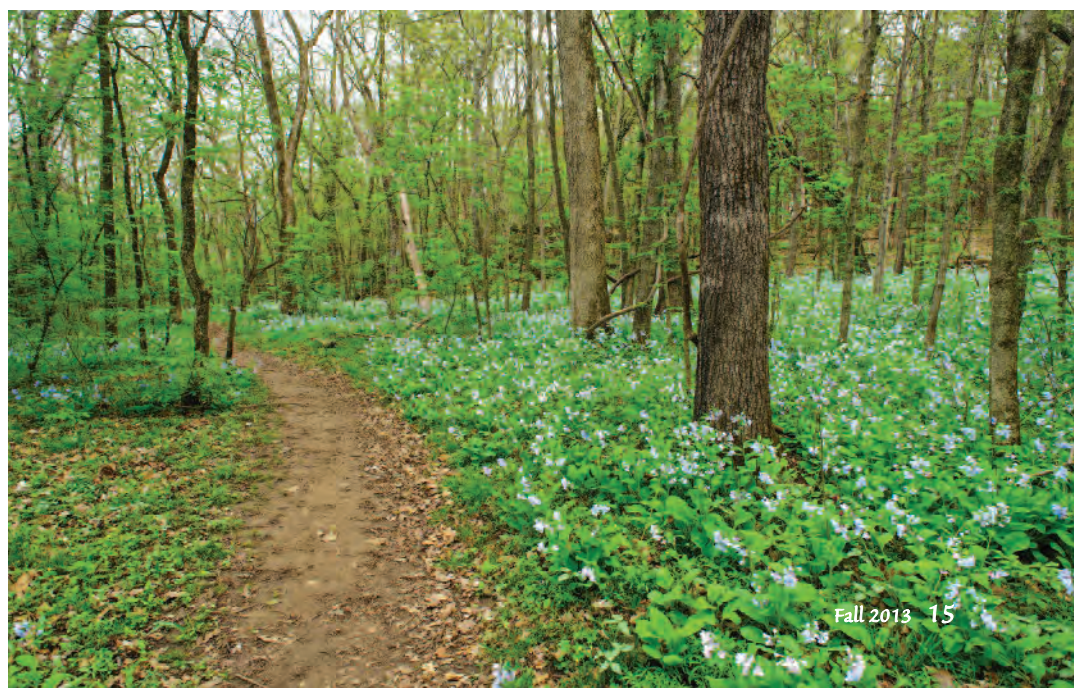
Tom Uhlenbrock is a writer for Missouri State Parks, a division of the Missouri Department of Natural Resources.

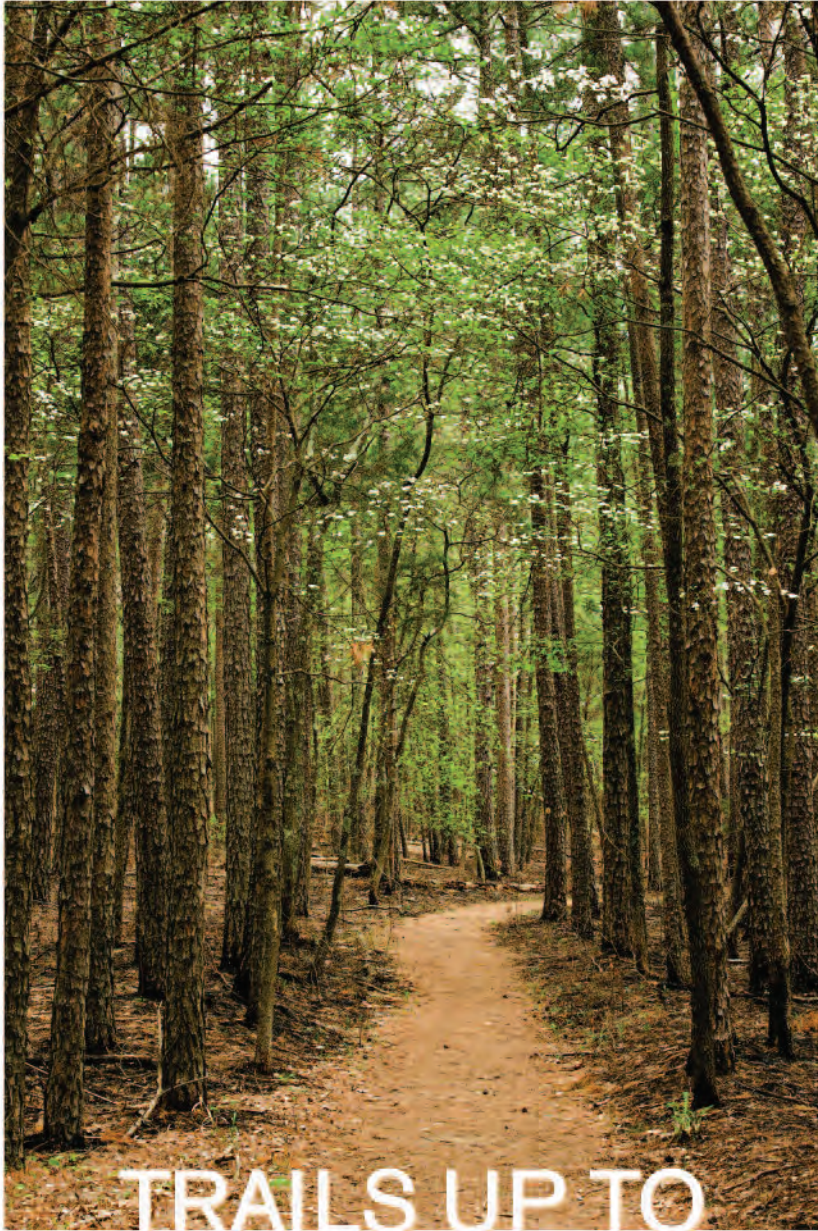
(Above) Participants can run, walk, bike, paddle, or roll to complete their "100 Missouri Miles" of physical activity by the end of the year.

(Above right) Gov. Jay Nixon and First Lady Georganne Nixon launched the 100 Missouri Miles Challenge in June to encourage Missourians to enjoy the outdoors.

(Below) Scenic trails, such as Swimming Deer Trail at St. Francois State Park, helped Missouri win recognition as "Best Trails State," by American Trails.

DNR photo by Scott Myers





TRAILS UP TO “THE CHALLENGE”

by Steph Deidrick

Looking for a trail to take on the Governor’s 100 Missouri Mile Challenge? Missouri State Parks has nearly 1,000 miles of trails that truly have something for everyone. From the paved trails that make a great spot for a sunset stroll, to a challenging hike through the wilderness, there are options for all ages and activity levels to enjoy. Trails are not just for walking; visitors can enjoy a water adventure on an aquatic trail, a day bike riding on the Katy Trail, or a horseback experience on an equestrian trail. A journey back in time is also possible as many of the trails at historic sites include interpretive panels along the way.





(Opposite page) Whispering Pines Trail at Hawn State Park meanders through a dramatic mix of hardwoods and pine forest. DNR photo by Scott Myers

(Left) The Mudlick Trail at Sam A. Baker State Park descends into Mudlick Hollow, which features a boulder-strewn stream. DNR photo by Tom Uhlenbrock

“Missouri State Parks recognizes that trails are valuable, and not just for their natural elements,” said Bill Bryan, director of Missouri State Parks, a division of the Missouri Department of Natural Resources. “Spending time on a trail is a great experience with a multitude of physical and mental benefits. Trails are like a free tonic for the mind, body and soul that makes our lives richer and happier.”

Check out these options in state parks and historic sites as you head out to take on the challenge.

Whispering Pines Trail – Hawn State Park, Ste. Genevieve Co.

Whispering Pines Trail is generally considered to be one of the best hiking and backpacking trails in the state. The trail provides the opportunity for day hikes of varying lengths or a longer backpacking trip. It meanders through a beautiful mixed hardwood and pine forest that is home to a variety of animals. Extensive exposures of sandstone and granite can be explored along the banks of Pickle Creek and the River Aux Vases. Mosses and ferns create a luxurious effect on the moist overhangs that occur along the two streams. The trail consists of two loops: the north loop is about 6 miles long and the south loop is approximately 3.75 miles.

Kelley Branch Mountain Biking Trail – Finger Lakes State Park, Boone Co.

This trail is inside the 90-acre Kelley Branch Restoration Area. Located in a scenic and rugged portion of the park, the 2.75-mile trail follows the wooded hills along Kelley Branch Stream. The trail is a single track that loops riders and hikers from the picnic area trailhead north, then to the southern-most point of the park, crossing Kelley Branch Creek. The route takes users through wooded landscapes that feature

steep mounds 20 to 30 feet high. It descends to the flat bottomland for a short ride, then back up the hillside where hikers pass a waterfall and the remains of a mining bridge.

Mudlick Trail – Sam A. Baker State Park, Wayne Co.

Whether you prefer riding horseback or hiking on foot, Mudlick Trail provides an intimate journey into the St. Francois Mountains, one of the oldest mountain regions of North America. Most of the trail is located in the Mudlick Mountain Wild Area, a significant, undisturbed natural landscape in Missouri. One of the features of the trail includes a gradual climb to the summit of Green Mountain. It offers a rewarding view, especially in fall and winter, when the trees in the thick oak-hickory forest have shed their leaves. The total length of the trail measures 16.75 miles, but is broken into two separate sections – the “Equestrian and Hike,” and the “Hike Only.”

Table Rock Lakeshore Trail – Table Rock State Park, Taney Co.

Open to foot traffic, wheelchairs and bicycles, this paved trail runs along Table Rock Lake and totals 2.25 miles. It parallels the shoreline and provides good views of the lake. There are dry woodlands and glades on the uphill side of the trail. Some of the oaks along the route are more than 200 years old. Bald eagles, loons and osprey are commonly encountered in the winter. Amenities include water fountains, restrooms, benches and bike racks. The trail is relatively flat and offers easy walking.

River Scene Trail – Castlewood State Park, St. Louis Co.

This trail is named for its main feature – the park’s most spectacular views, and is open to hiking and bicycling, although the bluff portion is hiking only. Totalling 3.25 miles, the route includes overlooks that provide stunning panoramic views of the

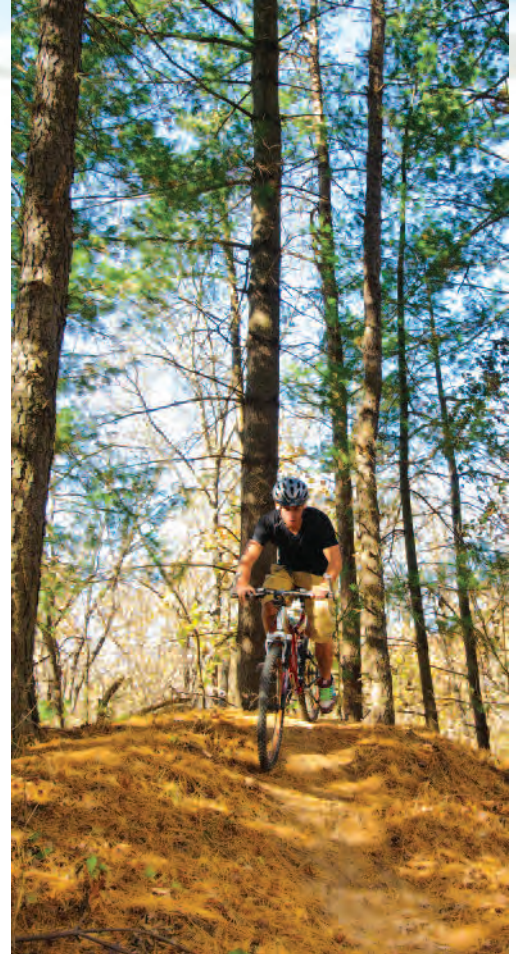
Missouri State Park Trail Facts

- Missouri State Parks offers almost 1,000 miles of managed trails in its state parks and historic sites.
- Visitors can enjoy approximately 215 miles of horseback riding on equestrian trails at 16 state parks.
- Almost 75 trails in Missouri State Parks are within designated wilderness and natural areas.
- Missouri State Parks' trail system includes 315 designated trailheads that provide parking and trail access to visitors.
- The most common trail marker, or blaze, color on Missouri State Park trails is yellow. More than 150 miles of trail in state parks and historic sites are blazed in yellow.



Courage Trail includes wayside exhibits with information about the Battle of Island Mound.
(Right) The Kelley Branch Mountain Bike Trail is inside the 90-acre Kelley Branch Restoration Area at Finger Lakes State Park near Columbia.
(Below) The Table Rock Lakeshore Trail is a relatively flat, paved trail that runs along Table Rock Lake.

DNR photo by Kelley Brent



DNR photo by Scott Myers

Meramec River valley. Hikers also will see many old foundations that serve as a reminder of the resort era during the 1920s and 1930s. Another sight along the trail is the Castlewood Railroad Depot.

Courage Trail – Battle of Island Mound State Historic Site, Bates Co.

Come walk the interpretive trail loop and learn about the Battle of Island Mound. This battle marked the first time that African-American troops were engaged in Civil War combat. Battle of Island Mound State Historic Site encompasses Fort Africa,

where the 1st Kansas Colored Volunteer Infantry camped in 1862, preceding a battle with pro-Confederate forces near a low hill named Island Mound. Information along the trail explains the effect the 1st Kansas Colored Volunteer Infantry

had on later Union decisions to allow African-American units to fight.

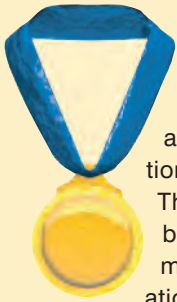
For more information about trails in Missouri State Parks, visit mostateparks.com or check out *Trails of Missouri State Parks*, a 422-page, full-color book that lists more than 230 trails in 58 state parks and historic sites. Each trail is summarized with a written description and a map that includes contour lines, GPS coordinates for trailheads and outstanding features such as overlooks. The spiral-bound book is available for purchase at mostateparks.com.

Steph Deidrick is the division information officer for Missouri State Parks, a division of the Missouri Department of Natural Resources.



DNR photo by Scott Myers

Parks Announced as Gold Medal Finalist



Missouri State Parks has been recognized as one of the top park systems in the nation as a finalist for the 2013 National Gold Medal Awards. The award is presented by the American Academy for Park and Recreation Administration, in partnership with the National Recreation and Park Association and Musco Lighting LLC.

The Gold Medal Awards program honors parks systems in the U.S. that demonstrate excellence in parks and recreation through long-range planning, resource management, volunteerism, environmental stewardship, program development, professional development and agency recognition. This year's winner will be announced live during NRPA's Annual Congress & Exposition in Houston, Texas, on Oct. 8-10.

Discharge Monitoring Report System Launched

The Missouri Department of Natural Resources has released a new online tool to help Missouri wastewater permit holders submit required discharge monitoring reports electronically.

The electronic discharge monitoring report, or eDMR, system will simplify the reporting process for Missouri's estimated 4,500 wastewater permit holders.

Some wastewater systems are required to submit discharge monitoring reports that summarize effluent monitoring results. The eDMR system allows wastewater treatment facilities to submit their reports via the internet, rather than through a paper recording and submission process.

The eDMR system will be faster and more efficient than the current system and will greatly reduce the amount of time and labor wastewater facilities spend preparing these reports. Additionally, eDMR will save the department time and improve accuracy by

eliminating potential errors that might be introduced by manual data entry.

The eDMR system is DNR's second major online initiative aimed at improving permitting time and efficiency. The ePermitting system, launched in June 2012, allows Missourians to apply for and receive land disturbance permits entirely online.

For more information, visit dnr.mo.gov/env/wpp/edmr.htm, or call the Department of Natural Resources' Water Protection Program at 800-361-4827 or 573-751-1300.

Online Permits Reach Milestone; Win Award

The Department of Natural Resources recently issued its 1,000th online land disturbance permit, a milestone for the program that represents years saved by applicants and department staff alike.



The ePermitting process, first rolled out in June 2012, allows applicants seeking a land disturbance permit – the most common of the permits issued by the department – to submit their application and receive the permit in a matter of minutes. In September 2013, the Environmental Council of the States selected the ePermitting program as one of three State Program Innovation Award winners for 2013. ECOS is a national non-profit association of state environmental agency leaders. Its purpose is to improve the capability of state agencies to protect and improve human health and the environment.

Building on the success of ePermitting, the department recently implemented eDNR, an online reporting program for wastewater plants that is much quicker and more accurate than the previous hard-copy reporting process.

"Our goal is to continue to use available technology to simplify the process for users and ease the demand on staff while still maintaining the same level of environmental oversight," Parker Pauley said.

Trail Project Receives Excellence Award

Missouri State Parks was recently recognized by the Society of Outdoor Recreation Professionals with a Project Excellence Award for their work on a trail inventory database and *Trails of Missouri State Parks* book. The awards are presented to recognize outstanding accomplishments in the field of outdoor recreation research, planning, management, and trails policy.

The project involved the creation of a comprehensive inventory to develop a trail database for Missouri State Parks containing information, images and up-to-date maps of every trail within the system.

The wealth of knowledge gathered through the inventory was then compiled into a beautifully illustrated, *Trails of Missouri State Parks*, which provides information on more than 230 trails in 47 state parks and historic sites. The award was presented during a ceremony on May 23 at the National Outdoor Recreation Conference in Michigan.

Earth Science Week 2013



"Mapping Our World," the theme of this year's Earth Science Week, will boost awareness about the many exciting uses of maps and mapping technologies in the geosciences. Each

year, the department's Missouri Geological Survey participates by sharing information with children and adults about how earth sciences play a fundamental role in the health, safety and welfare of all Missourians.

During the week, staff will recognize National Fossil Day Wednesday, Oct. 16; the Great Central U.S. Shake-Out, Thursday, Oct. 17; and Geologic Map Day Friday, Oct. 18, with special activities and exhibits.

Geologic Map Day is designed to promote awareness of geologic mapping and its vital importance to socie-

ty. Geologic Map Day focuses the attention of students, teachers and the general public on the study, use and significance of geologic maps for education, science, business, and a variety of public policy concerns. Special exhibits will be on display in the Edward L. Clark Museum of Missouri Geology, located at 111 Fairgrounds Road, Rolla. Plan to participate in Earth Science Week activities. To learn more, visit dnr.mo.gov/geology/education.htm#ESWeek.

Learn About Your Drinking Water



The Missouri Department of Natural Resources urges consumers to become more familiar with their local drinking water provider. The department has made it easier to do so

by becoming the first in the nation to post Consumer Confidence Reports online for each public water supply.

Federal law requires public water supplies to provide Consumer Confidence Reports to customers by July 1 each year. These reports enable Missourians to make practical, knowledgeable decisions about their health and environment. The reports also provide suppliers with an opportunity to explain how the community's drinking water supplies are protected and build on their relationship with the water customer.

To assist utilities with this effort, DNR has made the reports available to consumers on its website at dnr.mo.gov/env/wpp/pdwb/ccr.htm. Missouri was the first state to take this initiative after the U.S. Environmental Protection Agency decided last year to allow water systems to post the reports online in lieu of mailing paper copies to customers.

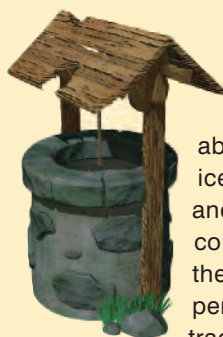
All community water systems are required to produce and distribute a Consumer Confidence Report. These systems include cities, water districts,

subdivisions, mobile home parks and other water systems serving at least 25 residents.

The department encourages the public to read their water system's Consumer Confidence Report and become better informed about their drinking water. Any citizen served by a community water system who has not received a Consumer Confidence Report should call their water provider and request a copy.

For more information, call the Department of Natural Resources at 800-361-4827 or 573-751-5331.

Well Permit Renewals Now Available Online



The department's Missouri Geological Survey is pleased to announce the availability of an online service in which well drilling and pump installation contractors may renew their permits. Online permitting allows contractors to renew and

print their permit and vehicle cards and pay associated fees immediately, for those contractors who have no outstanding violations against their existing permit.

The online permitting feature was added to the division's suite of online services, in addition to the Well Online Form Submittal (WOLFS) system, which was implemented by the division in fall 2012, and the Well Information search function implemented in spring 2013. WOLFS enables monitoring well contractors to submit monitoring well certification and registration forms and pay associated fees. This Web resource has proven to be significantly more efficient for staff and contractors. The search function is a resource for private citizens wanting to locate well or pump installation contractors who are permitted to do business in Missouri and search records for wells drilled after November 1987. The online form service is available at dnr.mo.gov/mowells.

Watershed Summits Held

Our Missouri Waters, the department's new vision for working with water resources at the watershed level, is continuing through its pilot phase. A watershed summit for the Spring River Watershed was held in Joplin at the end of May. More than 100 people participated, including many from the local community, as well as local, state and federal agency partners. The summit kicked off with a tour of the watershed that provided a visual perspective of the diverse characteristics of the Spring River basin, and recognized practices and projects that benefit the water resources and watershed community. The second and third days of the summit focused on information gathering and discussion around water resource topics in the Spring River watershed, such as stream water quality and watershed planning, wastewater and drinking water infrastructure, and long-term water supply and drought planning.

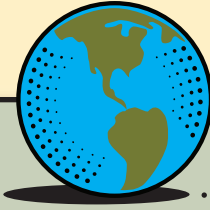
The other focus watersheds during the pilot phase are the Lower Grand in north-central Missouri and the Big River in the southeast. The department's regional watershed coordinators are already working with partners in these watersheds to share information and plan for gatherings similar to the Spring River summit. The date for the summit in the Lower Grand is Sept. 10, 2013, with the Big River summit slated for Oct. 9.

To learn more about Our Missouri Waters, the Spring River Water summit, and to sign up for updates, visit dnr.mo.gov/omwi.htm.

Focus Groups for Education

In a continued effort to serve Missouri communities and bring natural resource expertise to the general public and Missouri youth, the Department of Natural Resources currently is evaluating its education outreach efforts.





environmental notes

This past summer, the department hosted multiple statewide Education Focus Group meetings to determine what adult educators need to inform and educate our youth as it relates to preserving and protecting the state's natural and cultural resources. The department is focusing these meetings on K-12 youth through formal and informal education efforts.

The focus groups were well attended and offered valuable information that will provide direction to the department and help us serve Missourians in the best way possible.

For more information about the Department of Natural Resources' youth education efforts, visit dnr.mo.gov/education/index.html.

Grant for Geological Survey Program

The U.S. Geological Survey recently awarded a STATEMAP grant in the amount of \$134,667 to the department's Geological Survey Program. The funds are to support advance detailed geologic mapping in the Jefferson City-Columbia area and large-scale compilation geologic mapping in the St. Louis area.

Since 1993, the Department of Natural Resources has actively participated in the USGS National Cooperative Geologic Mapping Program and has produced 107 bedrock and 99 surficial material geologic maps for locations across the state.

Geologists will coordinate supporting data from the Department of Geological Sciences and Engineering at the Missouri University of Science & Technology in Rolla.

Bedrock and surficial material geologic mapping in Missouri is needed to establish the geologic framework of areas determined to be vital to the economic, social and environmental well-being of the state. Learn more about the STATEMAP mapping program at dnr.mo.gov/geology.

Bubble Bubble ... Toilet Trouble



A properly functioning wastewater treatment system is a necessity for keeping wastes flowing smoothly out of your sewer. In a rural state like Missouri, many homes lack access to centralized sewer systems and instead must opt for an on-site septic system. While time-tested and low-maintenance, these systems require attention to make sure they function properly.

The key areas involved in keeping a septic system healthy center around proper inspection, periodic pumping, proper waste disposal, water efficiency and drain field care. In a septic system, wastewater flows from the home into a septic tank where it is held long enough that heavy solids, called sludge, are allowed to settle. Grease and lighter solids float to the top forming a layer called scum. The middle layer of wastewater then flows into a series of perforated underground pipes in a drain field where it is naturally cleaned and disinfected as it is reintroduced into the environment. On average, a septic tank should be pumped to remove excess solids and grease once every three years.

A system clogged with scum and sludge can cause wastewater to back up into the house or escape into the yard. For this reason it is good to be mindful of what you put down the drain. Toilets are not trash cans, so flushing large amounts of waste that does not break down in a septic system can cause problems down the line. Avoid putting things like cotton swabs, cigarette butts, coffee grounds and grease down the drain. In addition, items such as household or photographic chemicals and paint can wipe out beneficial bacteria that live in septic systems and are important for their proper function. These chemicals also can contaminate groundwater, find their way into local waterways and harm the environment, as well as clog the drain field, causing backups.

The more water a household conserves, the less enters a septic system for treatment. It is important to fix leaky faucets and toilets. Just one cup of leaking faucet water every ten minutes equals 36 gallons of water wasted in a day. In addition, the installation of high-efficiency toilets and showerheads, as well as faucet aerators, can significantly decrease water usage.

By heeding the tips above, a homeowner also can avoid costly repairs and the possibility of legal liability should the system fail. An unusable or malfunctioning septic system also can lower your property value. With proper care, a septic system can remain in operation almost indefinitely.

For more about septic systems, and tips for identifying a malfunction, visit the U.S. Environmental Protection Agency's SepticSmart website at water.epa.gov/infrastructure/septic/septicSMART.cfm.

Additional information about septic systems can be found on the Missouri Department of Health and Senior Services website at health.mo.gov/living/environment/onsite/index.php.

Tipton Awarded Drinking Water Grant

The Missouri Department of Natural Resources has awarded a \$606,600

low-interest loan for the replacement of approximately 6,800 feet of drinking water distribution lines in Tipton. Funding for the loan comes from Mis-

souri's Drinking Water State Revolving Fund. The fund provides assistance for communities with drinking water infrastructure needs. A portion of the funding will be targeted toward green infrastructure, water and energy efficiency, and environmentally innovative projects.

This funding will help the city of Tipton protect its residents and the environment by making necessary drinking water improvements.

The department's Water Protection Program administers the loan funds and is committed to working closely with communities to support water and wastewater infrastructure improvement projects.

For more information, contact the department's Financial Assistance Center at 800-361-4827 or 573-751-1192, or visit dnr.mo.gov/env/wpp/srf.

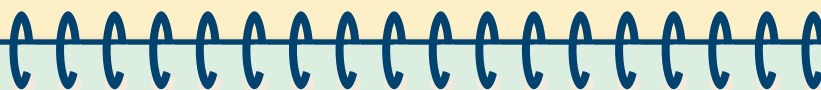
Bunceton Awarded Wastewater Grant

The Missouri Department of Natural Resources has awarded a \$100,000 loan to the Cooper County city of Bunceton for installation of an ultraviolet disinfection system to eliminate bacteria from the wastewater treatment plant's water discharge. Ultraviolet disinfection destroys pathogens to prevent the spread of waterborne diseases to downstream users and the environment.

The loan will be financed through repayments of loans made from Water Pollution Control bonds. The department's Financial Assistance Center provides funding to assist communities with infrastructure needs for water quality, wastewater and drinking water.

A portion of the funding will be targeted toward green infrastructure, water and energy efficiency, and environmentally innovative projects implemented by the city of Bunceton.

The department's Water Protection Program will administer the loan funds. For more information, visit the Water Protection Financial Assistance Center online at dnr.mo.gov/env/wpp/srf.



Stream Team Notebook

Old Stream Team Finds New Passion

The Missouri Stream Team program started in 1989 and so did Stream Team 31, Ozark Fly Fishers. One of the oldest and largest Stream Teams, for many years they participated in stream cleanups and quietly removed trash from the river while fishing. However, a core group of members decided to become more involved with the program. In 2002, they attended a water quality monitoring workshop designed for anglers at Montauk State Park.

"That's when it all really started," stated Mike Swederska, former president of the club. "About eight or nine members went to the VWQM training and they started doing regular monitoring." Adopting stream sites on the Current River, Mill Creek and Blue Springs Creek, these enthusiastic fishermen set about protecting their favorite resource.



Scott Darrough, Glenn Bish and Mike Swederska

"One of the things we are proudest about is the fact that we were able to leverage matching funds to raise \$15,000 in less than 12 months to help purchase Bohigian Conservation Area and return it to public use," Swederska said.

Explaining their motivation to continue their endeavors, Glenn Bish said, "For me it is all about protecting the environment and improving the streams that we love. We want those resources to be available for future generations to enjoy." Scott Darrough added, "I want to do the best I can to leave this world a better place than I found it, and hopefully someone will come along and continue the work when I am gone."

Other annual activities include participating in Operation Clean Stream, Bio Blitz and other environmental programs. This 300-member Stream Team and their three trained monitoring teams – captained by Glenn Bish, Scott Darrough and Bill Leslie – are definitely making a difference on their adopted streams. Let's hope they will continue to do so for another 24 years.



DNR photo by Karen Westin

State Funding for Cameron Drinking Water Plant

More than \$1.1 million in financing for improvements to the city of Cameron's drinking water treatment plant has been awarded by DNR.

The city will receive a \$490,500 grant and a \$616,000 low interest loan, which will be used to convert the

plant's disinfection system from chlorine to chloramine.

Funding for the grant and loan comes from the Drinking Water State Revolving Fund. The fund provides financial assistance to communities with drinking water infrastructure needs. This funding will help the city protect residents and the environment

TIME EXPOSURES



As manufactured glass plate film and simplified cameras became readily available in the 1880s, photography became a practice not only for professionals, but for the average, everyday American. People like Charles Elliott Gill, a farmer from Dent County, began documenting the world around them, creating an important window into the turn-of-the-century rural Missouri lifestyle. Gill received his first camera when he was 18, but did not begin documenting his life until in his forties. For more than 30 years, Gill used the same camera he bought as a teenager to doc-

ument his time and travels around the Ozarks and on his farm. His photographs depict farm life in Dent County, as well as the lifestyle of communities in the area.

Gill married Myrtle Hayes in 1917 and they had a son, Edward Allison Gill, in 1918. The marriage ended in divorce in 1921, and Gill never remarried. He died on July 15, 1962, at the age of 93.

In 2002, his son Edward donated his father's collection of 722 glass plate negatives and original prints to the Missouri State Archives in Jefferson City.

The photo at left was taken of the Gill family in 1912, in a rural Missouri pumpkin field. Harvey Gill is standing near the center of the image, with hat and cane in hand.

Photo courtesy of the Charles Elliott Gill Photograph Collection, Missouri State Archives.

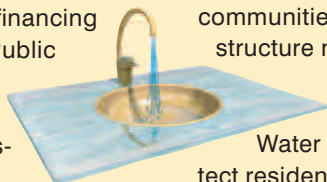
Send your photo to "Time Exposures," c/o Missouri Resources, PO Box 176, Jefferson City, MO 65102-0176. Original photos will be returned via insured mail. Pre-1970 environmental and natural resource photos from Missouri will be considered. Please try to include the date and location of the picture, a brief description and any related historic details that might be of interest to our readers.

by making necessary public drinking water improvements.

The department's Water Protection Program will administer the grant and loan funds. For more information, visit the department's Water Protection Financial Assistance Center online at dnr.mo.gov/env/wpp/srf.

Jefferson County Water Improvements

The Missouri Department of Natural Resources has awarded financing totaling \$1.73 million to Public Water Supply District No.12 of Jefferson County to improve its water distribution system.



District No.12 will use the funds – an \$866,000 grant and an \$866,000 low-interest loan – to replace water mains along U.S. Highway 61 from the water supply district office and out to Airport Road.

It also will construct a water main extension at the intersection of Interstate 55 and U.S. Highway 61. Funding for the loan comes from Missouri's Drinking Water State Revolving Fund.

The fund provides assistance for communities with drinking water infrastructure needs.

This funding will help Jefferson County Public Water Supply District No.12 protect residents and the environment by

making necessary drinking water system improvements.

The department's Water Protection Program will administer the funding.

For more information contact the department's Financial Assistance Center at 800-361-4827 or 573-751-1192 or visit dnr.mo.gov/env/wpp/srf.

For news releases on the Web, visit dnr.mo.gov/newsrel/.

For a complete listing of the department's upcoming meetings, hearings and events, visit the department's online calendar at dnr.mo.gov/calendar/search.do.

Looking for a job in natural resources? Go to dnr.mo.gov/hr/.

Resource Honor Roll Continental Coal Inc.

Continental Coal Inc. (CCI) of Kansas City recently received the Interstate Mining Compact Commission's (IMCC) Small Operator of the Year Award for surface coal mining. This award was given to CCI for their exemplary performance in mining and reclamation at the Cottonwood Creek Mine just north of Hume, Mo. in Bates County. Phil Tearney, president of the company, accepted the award at the commission's annual meeting in Cincinnati, Ohio on April 16, 2013.

The Interstate Mining Compact Commission is composed of 25 member and associate member states represented by their governors who serve as commissioners.

Kevin Mohammadi, director of the Department of Natural Resources' Land Reclamation Program, is the duly appointed representative of the governor.

"The IMCC is committed to recognizing the mining companies that are environmentally conscientious in their operation," said Mohammadi. "These companies take environmental protection seriously."

The mining and reclamation work at the Cottonwood Creek Mine was finished ahead of schedule and in a quality manner. The mining and reclamation is supported by highly effective design plans which resulted in enhancements for wildlife, agriculture and water resources. Steve Femmer of the department's Land Reclamation Program made the nomination for this award.

"The reclaimed land blends in very well with the neighboring farms and fixes some old problems from past mining," said Femmer. "That is a very positive result from good mining and reclamation practices."



Philip E. Tearney,
President, Continental Coal Inc.

Rock Matters

Shale

Consisting of innumerable fine layers, or laminations, that can be easily separated, shale is made up of tiny silt, mud or clay particles compacted together. The process in the rock cycle which forms shale is called compaction.

Shale is a very common form of sedimentary rock composed of clay, fine silt or mud that has been compacted into solid rock by burial beneath other sedimentary rocks. Shale generally is smooth to the touch and soft enough to be easily scratched or broken. Usually thin-bedded, layered or laminated, and tends to break along parallel bedding planes, shales come in a variety of colors. Some are gray, green and red, while others are dark brown and black. Often between the layers are animal burrows and fossils of both marine creatures such as brachiopods and land plants such as lepidodendrons.

People sometimes confuse shale with slate, a much harder rock. In manufacturing, shale is used as a filler material for Portland cement – a basic ingredient of concrete, mortar and stucco – and brick, tile and ceramics, to name a few uses.

Black shale is commonly associated with coal beds in northern and western Missouri. Under certain geologic conditions, oil and gas accumulate in what is known as "oil shale" and can yield oil and gas from the burial and thermal alteration of shale or mudstone. However, tremendous energy is needed to extract these compounds, making this rock more appealing in regions where other sources of oil have been exhausted. Although Missouri has tremendous amounts of thinly bedded black shales in the Forest City Basin, located in northwest Missouri, none of these rock



(Foreground) Shale, used in the manufacture of Portland cement (background) pictured here in the form of a support pillar. DNR file photos

units are currently producing oil or gas. Read about oil and gas in Missouri at dnr.mo.gov/geology/docs/gcsummer7.pdf.

The most recent U.S. Geological Survey report identifies the 10 leading shale and clay (USGS combines shale and clay statistics) producing states, in decreasing order of tonnage, as Georgia, Wyoming, Alabama, Texas, North Carolina, Missouri, California, Ohio, South Carolina and Mississippi. Learn more about shale and other common Missouri rocks and minerals at dnr.mo.gov/geology/docs/rocksetbooklet.pdf.

Ten Years Later

MR Returns to Quarterly Schedule

by Stuart Westmoreland

Keeping up on the latest stories about Missouri's natural resources and state parks is about to get a little easier when *Missouri Resources* returns to a quarterly publication schedule with the winter 2014 issue. Once again, *MR* will hit the streets around the time the seasons change, just as nature intended.

Ten years. Seems like a long time. Several months ago, when we were laying the groundwork (that's government-speak for "trying to find the money") to return *Missouri Resources* to its original quarterly publication schedule, someone asked me when we cut back to three issues per year. 'Four or maybe five years ago,' I replied, fairly certain I was in the ballpark. It was 2003.

Grabbing an archive copy of *MR*, I wanted to see what was going on in this agency exactly one decade ago when we cut back to three issues. We could have almost cut the Director's Comments from summer 2003 and pasted them into this issue, saving current DNR Director Sara Parker Pauley some time. A few update edits and we'd be good – even the word count was right on the screws.

"In Missouri, and most other states, all levels and branches of government, as well as our universities and public schools, are struggling to make every nickel and dime stretch," said Steven Mahfood, the DNR director in 2003. "That same problem seems to be making its way into our homes and businesses, as well," Mahfood continued.

Mahfood's uncle, who was Yogi Berra (yes, *that* Yogi Berra),

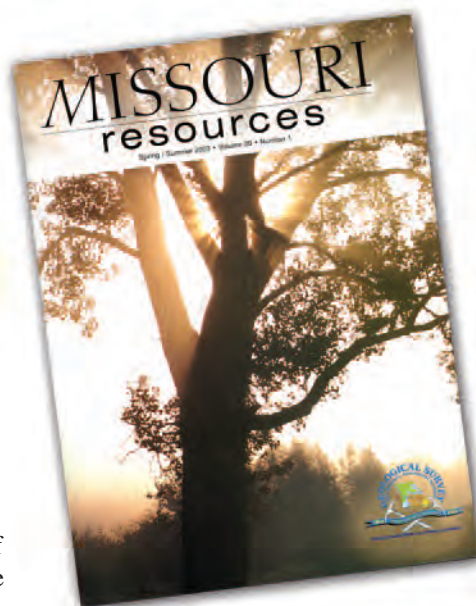
probably would say, "It's déjà vu all over again."

The entire article detailed many of the specific cuts our agency would be working through, including cutting *MR* from four to three issues per year. Do more with less, we're all doing it these days. *We should* be doing it. It's not just state government, everyone has to work faster, smarter and rely on technology. Technology is what has kept printing costs in check through the years. And although postal costs still go up, good list management and accuracy help control it. So now that we're back on schedule, we will be expanding some content, reducing others and tweaking our "look."

Missourians value clean air, water, soil and a healthy outdoors in which to recreate. This message was made clear to me as I read over your comments from an online survey of our existing subscribers. You also conveyed what you wanted to see more of, and what you could do without.

Regarding content, state parks, historic sites, trails and natural areas headed the list of what our readers prefer to read about. Not far behind were streams, lakes, wetlands, rocks, minerals and geologic wonders. Beginning with the winter issue, which will mail in mid-December, two additional parks entries will be added, along with regular feature stories from state parks.

Explore Missouri will replace Resources to Explore, and in lieu of focusing on one park or historic site, multiple parks events normally entered as news briefs will be expanded



in this section. In addition, two new entries – Tops Spots and Trails Highlight – will include best spots in Missouri State Parks to camp, fish and myriad other topics. The new trails page will feature a different trail each issue and include details and photos that space didn't previously allow.

We've also increased the pages devoted to feature stories, and have reduced the text to allow for more and larger photos. Obviously, with the same number of pages, some regular departments had to be reduced or eliminated. Using the survey as our guide, our template was revised accordingly.

MR staff also have heard from many of our state's educators who would like more resources to use in the classroom. So, next issue, many of our features will include links where additional information about a story or topic can found on our DNR education pages at dnr.mo.gov/education.

We hope you enjoy the new content, an updated style and a return to quarterly publication. As always, we welcome your feedback and look forward to hearing from you in 2014.

You can email *Missouri Resources* at moresdnr@dnr.mo.gov.

Stuart Westmoreland is a public information administrator and editor of Missouri Resources.

**MISSOURI DEPARTMENT
OF NATURAL RESOURCES**
PO Box 176
Jefferson City, MO 65102-0176

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